DOCUMENT RESUME

ED 386 151 IR 017 268

AUTHOR Fryer, Michelle L.
TITLE Ministry, Union, the Church and Teachers: Bolivia's Partners in Innovation. LearnTech Case Study Series, No. 6.
INSTITUTION Education Development Center, Washington, DC.
SPONS AGENCY Agency for International Development (IDCA), Washington, DC. Bureau for Research and Development.
PUB DATE May 95
NOTE 40p.
AVAILABLE FROM Education Development Center, 1250 24th St., N.W., Suite 300, Washington, DC 20037 ($5 plus postage).
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Case Studies; *Educational Radio; Elementary Education; Foreign Countries; Government Role; *Mathematics Education; *Partnerships in Education; Program Implementation; Teacher Education
IDENTIFIERS *Bolivia; *Interactive Radio

ABSTRACT

A process of developing and testing an instructional methodology called interactive radio instruction (IRI) was begun in 1986 in order to improve the quality of primary school mathematics in Bolivia. When the development phase was complete and implementation well under way, management of the resultant Radio Learning Project (RLP) passed from the non-governmental organization (NGO), Fe y Alegria, to the Ministry of Education and Culture (MEC). Today, seven years after the initial pilot, approximately 600,000 primary-school children have enrolled in the RLP, renamed PARI; more than 8,000 teachers have been trained and certified in the IRI methodology, and in 1992, Radio Math achieved national recognition as the "official" mathematics program of Bolivia. This case study assesses how NGO management sustained RLP continuity, describes how broad-based teacher support laid the base for institutionalization, and looks at how IRI has revolutionized education in Bolivia. Rather than dwell on issues related to methodology or impact, the study assesses the sustainability of PARI from the sociological perspective, focusing on the issues of participation of people and systems key in driving national diffusion and sustainability. An appendix provides a chronology of events. (Contains nine references.) (Author/MAS)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 386 151

MINISTRY, UNION, THE CHURCH AND TEACHERS:

BOLIVIA'S PARTNERS IN INNOVATION

LearnTech Case Study Series No. 6

Michelle L. Fryer

May 1995

IR017268

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Laura Coughlin

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Additional interviews by Cecilia Crespo
Layout by Amy Garay

For more information, contact:

Education Development Center
1250 24th Street, NW
Suite 300
Washington, D.C. 20037 USA
tel: (202) 466-0540
fax: (202) 233-4059

This document was drafted for the Learning Technologies for Basic Education project, which is implemented by the Education Development Center and funded by the Bureau for Global Programs, Field Support and Research, United States Agency for International Development, Bureau for Research and Development, Office of Education under contract DPE-5818-C-00-0044-00.

Acknowledgements

This case study was prepared as part of Education Development Center's work under the Learning Technologies in Basic Education (LearnTech) Project. LearnTech is the United States Agency for International Development's (USAID) primary mechanism for assisting governments and USAID missions worldwide in the design, implementation, and evaluation of educational technology initiatives. Financial support for the interactive radio projects reviewed in this case study is provided by USAID, the Government of Bolivia, and Fe y Alegria. The U.S. based Education Development Center is the primary international technical assistance provider, and Programa de Educación por Radio (PER), is the local implementing agency.

I would like to thank a number of people for their contribution to this paper. First, I should thank LearnTech's Mike Laflin, for believing Bolivia's story worthy of telling, and Andrea Bosch for her editorial guidance and encouragement along the way. I am also indebted to Bambi Arrellano, Paul Hartenberger, Sigrid Anderson, and James Hoxeng of USAID for their able guidance and continuing advocation of Bolivia's work. Most important, I would like to thank my Bolivian colleagues for their immeasurable contribution to making Bolivia's Interactive Radio Learning Program, PARI, the largest *national* IRI program ever. They include:

- **Lic. Emilio Oros Mendez**, Executive Director, PER
- **Prof. Betty Barrón de Luna**, Director of Evaluation & Implementation, PER
- **Lic. Jaime Reyes Valasquez** , Director of Curriculum & Production, PER
- **Lic. Jorge Ayala Claros**, National Coordinator, MEC
- **R.P. Gabriel Codina**, National Director, FyA
- **R.P. Victor Blajot**, Director, Radio Santa Cruz, FyA
- **H. Maria Otaegui**, FyA Santa Cruz
- **H. Gloria Esposito**, FyA Cochabamba
- **Prof. Daniel Escalante**, Regional Coordinator, PER
- **Prof. Ana Rosa de Achá**, MEC
- **Lic. Vicente Mendoza**, Director, Instituto Internacional de Integración

The challenging exchanges that we engaged in throughout my tenure with PARI and during the development of this paper profoundly influenced the final draft.

Table of Contents

Overview 7

Seeds of a Project: Responding to the needs of a nation 8

Decentralization and Fe y Alegria 9

Early Results: Students, Teachers and Parents Respond 11

Teachers: A Key Element 13

NGO/Ministry Collaboration: Decentralization at Work 15

Starting with an NGO 16

Managing Growth 17

Curriculum Development: A Lengthy Process 18

Building Partnership with the Teachers 20

Responding to the Teachers 21

Honoring Recommendations 23

Enhancing and Rewarding Teacher Knowledge 23

The Teachers' Guide 24

Teacher Training 24

Teachers as Advocates 25

Instuctional Design: Catering to the Learner 26

Making Instruction Effective 27

Encouraging Active Student Participation 28

Making Learning Relevant 28

Making It Rewarding 29

Institutionalization and New NGOs: Adapting to Change 29

Founding Programa de Educacion for Radio 30

Final Thoughts 33

ANNEX A: Chronology of Events 35

ANNEX B: Endnotes 40

Overview

In 1986, Fe y Alegria (FyA), a Bolivian non-governmental organization (NGO) sponsored by the Catholic Church, began the process of developing and testing a powerful instructional methodology called "interactive radio instruction" (IRI) to improve the quality of primary school mathematics. Throughout the following year, feasibility studies, needs assessments, and pilot implementation activities challenged the appropriateness of the intervention and Fe y Alegria's role as the lead institution in a country-wide initiative. Would it work in Bolivia? Would the teachers and students like it? The dramatic improvement in student learning produced by the initial pilot, however, confirmed both children's readiness to "take off" with the radio instruction and FyA's intellectual and institutional capability of continuing management at the national level.

Four hundred and fifty second-grade students participated in the initial Radio Learning Project (RLP) mathematics pilot. By 1991, the complete set of 540 lessons for grades 2-5 had been validated and the Ministry of Education and Culture (MEC) was considering expanding access to all schools. With the development phase complete and implementation well underway, management of Bolivia's Interactive Radio Learning Program (PARI, the new project's name) passed from FyA to the MEC; and in 1992, PARI began validating a new IRI-based preventive health curriculum for upper-primary school. Today, seven years after FyA's initial pilot, approximately 600,000 primary-school children have enrolled in RLP/PARI; more than 8,000 teachers have

Enrollment in the Radio Learning Project and PARI has reached 600,000 students.

been trained and certified in the IRI methodology, and in 1992, Radio Math achieved national recognition as "the official" mathematics program of Bolivia.

Its decentralized evolution has set this project apart from most other education projects around the world. This case study assesses how NGO management sustained RLP continuity, it describes how broad-based teacher support laid the base for institutionalization, and looks at how IRI has revolutionized education in Bolivia. Rather than dwell on issues related to methodology or impact, the study will assess the sustainability of PARI from the sociological perspective, focusing on the issues of participation of people and systems key in driving national diffusion and sustainability.

Seeds of a Project: Responding to the Needs of a Nation

In 1985, Bolivia's primary education system was in a state of crisis, and the national economy was on the verge of collapse. Just 32 of every 100 students who began first grade completed fifth grade, and student repetition rates were pegged at 30%. Hyperinflation had firmly established itself at 24,000%, severely limiting government's ability to respond to the public demand for quality education. Because the MEC could not maintain teachers salaries at even minimal standards, educational opportunities declined. The resulting shortfall of trained teachers, absence of textbooks and other instructional aids, and exaggerated teacher absenteeism provoked a profound loss of confidence in public education.

A 1987 study of primary-school desertion conducted by the Bolivian Center for Educational Research and Action (CEBIAE) noted an alarming decrease in the number of children matriculated between 1976 and 1984. It concluded that not only was the economic crisis influencing parents' decisions to send or not send their children to school, it was also a decisive factor in teacher abandonment. Other factors affecting drop-out reflected the poor quality of instruction, and the lack of relevance in programming. During this period, students lost upwards of a month of instruction out of every school year to teachers' strikes; and on the days that school was in session, many students were inattentive, unattended, or treated as the object rather than the subject of education.

In 1986, Bolivia adopted a far-reaching economic plan aimed at restoring price stability and restructuring the economy. Reform of

Bolivia's weakened education system, however, lagged behind. Teachers' skills needed to be upgraded, the curriculum needed to be revised, the administrative/supervisory system needed to be restructured, and infrastructure needed to be improved. In other words, what took a decade to destroy would take generations to rebuild; and public dissatisfaction with existing services was high.

The inefficiency of the public-school system fueled movement in Bolivia's urban centers towards private, fee-paying schools. At the same time, parallel movement in peripheral areas supported the decentralization of education, or the private administration of public schools by non-governmental organizations. Such organizations generally operated through ministerial agreements under which the NGO administered the school and the Government paid the teachers' salaries. The participation of NGOs in formal education was limited almost exclusively to the Catholic Church, which represented about 13 percent of all enrolled children. (The World Bank 1993). The Radio Math pilot project chose to follow these new trends in decentralization and to rely on an NGO to improve public education.

Fe y Alegria's efforts focus on teachers' skills, student needs and parental participation.

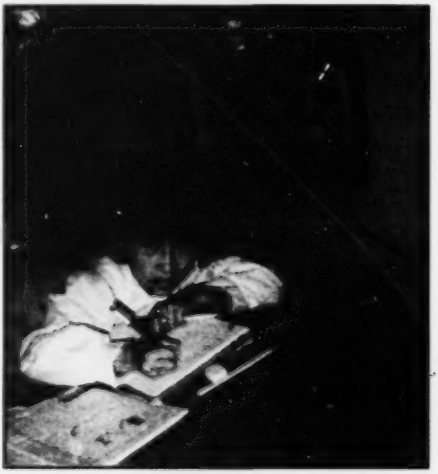
Decentralization and Fe y Alegria

Fe y Alegria is the largest of the Catholic NGOs. Their mission is to extend educational opportunities to underserved communities in Bolivia. Throughout their nearly 30 years of service, FyA has demonstrated an excellent capacity as an institution to efficiently administer a complex network of schools and provide in-service

support for teachers. In 1986, FyA directed 195 public education centers with more than 78,000 students and 3,100 teachers. Enrollment in their schools is free and open to all students. FyA efforts focus on improving teachers' skills, making schooling more relevant to individual needs, increasing parental participation in the educational process, and raising the overall level of social consciousness within the community. Located primarily in the poorer suburban and rural areas, each center uses the official curriculum as a basis for instruction; however their programmatic orientations differ (production, scholastic, vocational, etc.) according to the needs and expectations of the communities they serve. FyA outreach also extends beyond the formal school environment and includes the oldest and largest adult literacy program in the country—IRFA (Radiofonic Instruction, Fe y Alegria).

In 1986, the Episcopal Education Commission (CEE), the coordinating committee for the Catholic NGOs, requested USAID/Bolivia assistance to assess the potential of using IRI to improve primary-school mathematics instruction. They were motivated by the need to establish an immediate quality input that could be easily managed until the MEC had a more rigorous instructional system in place.

Children's ability to think critically was heightened through the instructional radio programs.



While the initial feasibility study confirmed the viability of using IRI in the schools, it cautioned against taxing the MEC with the additional burden of project management. Instead, it recommended that an NGO manage the developmental phase of the project. The

feasibility study also suggested that a pilot be undertaken to: 1) verify that Bolivian school children can learn significantly more from the radio-based methodology than by traditional instruction; 2) evaluate whether the radio mathematics curriculum and lessons originally developed by previous IRI projects in Central America might be appropriate for adaptation in Bolivia; 3) evaluate whether Bolivian teachers would be able to use the interactive-radio programs effectively with a minimal amount of training or supervision; and 4) assess local capability to implement the project institutionally, administratively, and technically.

> *"...we were not entirely clear about what was really involved. The pilot provided FyA an opportunity to test IRI..."*
>
> R. P. Victor Blajot, Director, Radio Santa Cruz, FyA

Although Fe y Alegria schools operate more efficiently than do other public schools, they too were concerned about the quality and level of instruction in core subjects like mathematics and language. This prompted them to join together with EDC to pilot-test the Radio Mathematics methodology and lay the foundation for Radio Learning Project.

Early Results: Students, Teachers and Parents Respond

> *"I was concerned about the quality and morale of the professors so I was open to going ahead with the pilot. I saw a solution to a problem."*
>
> H. Maria Otaegui, FyA Director Santa Cruz

In 1987, Bolivia became the first country in South America to use IRI. Between April and July of that year, the FyA staff adapted, produced, and broadcast the first 20 lessons of the second-grade curriculum. A total of 450 students and 11 teachers in the cities of Santa Cruz and Cochabamba participated in the pilot. Gains in student mastery of basic concepts taught by the radio were measured through pretests and posttests in all participating schools. Student/teacher interaction with the instructional-radio program was evaluated through daily observations in participating classrooms. Teachers' impressions were gathered through written questionnaires and by focus-group interviews. From this we learned that:

- Bolivian school children can easily learn mathematics by interactive radio. Teachers observed that the radio students seemed to be more alert and more actively involved in the learning process than were children in traditional classes. Other teachers commented that children's ability to think critically was heightened through the instructional-radio programs; and still others noted how IRI was contributing to the development of Spanish-language skills among bilingual students. Table 1 illustrates the dramatic gains in student mastery achieved during the pilot.

- Bolivian students entering second grade have the necessary prerequisite skills in numeration, addition, and simple subtraction to "take-off" with the radio lessons. No modification of the first grade curriculum would be needed to prepare the students for the radio intervention.

- Bolivian teachers can effectively use the interactive-radio lessons with basic training. During a one-day orientation, teachers were familiarized with the classroom materials, radio lessons, testing instruments, and postbroadcast activities. Throughout the pilot, teachers demonstrated a high degree of competence when using the instructional radio programs.

- Fe y Alegria had the institutional capacity to handle the technical and managerial aspects of the project with continued technical assistance. The administrative structure of FyA proved strong enough to support initial project implementation activities and act as a springboard for national dissemination within Bolivia.

The results of the 1987 Radio Mathematics pilot were extremely encouraging.

TABLE 1. MEAN PILOT RESULTS
GRADE TWO MATHEMATICS: LESSONS 1-20

		First Language		Test Results	
Schools	**Region**	**Spanish**	**/ Quechua**	**Pre /**	**Post**
6	Cochabamba	49%	51%	59%	90%
5	Santa Cruz	100%	--	69%	89%
	MEAN SCORE:			**64%**	**90%**

Teachers: A Key Element

Not only did the radio intervention inspire children to learn more by actively involving them in the learning process, it also challenged teachers to break with the traditional form of instruction—rote learning.

> *"For years, the teachers were used to using the blackboard and a teacher's guide that they made themselves. So coming in with a new method that included a radio wasn't easy for the teachers, students, school directors or supervisors to accept. The parents had a hard time accepting it, too."*
>
> Professor Jorge Ayala, National Coordinator, MEC

Teachers interpreted the success of their students as their own success.

The Bolivian pilot carefully focused attention on the role of the teacher in facilitating the radio class and in leading the post-broadcast session. According to Gabriel Codina, National Director of Fe y Alegría,

> *"Not all of the teachers felt involved and committed to the programs. The teachers who took an interest in the program from the very first used the new methodology well. They progressed and improved professionally and personally. Teachers who applied the methodology in a rote manner or were reluctant to implement it, did not benefit personally or substantially improve their teaching skills."*

Although many teachers entered into the pilot concerned that the radio could replace them they generally finished by embracing the

methodology. They interpreted the success of their students as their own success, and came to view the radio as an important tool for learning. Teachers wanted to continue with IRI and expand its application to science, language, and social studies. Long-held perceptions of teaching and learning were beginning to change.

The enthusiasm of the students for Radio Math motivated parents to seek additional information about the program. Parents who had previously felt disenfranchised from the education system expressed hope. They were curious about what their children were doing. In one school on the road to Cochabamba, parents who had never stepped foot in the classroom before came to see what was happening with the radio.

Other parents frequented their local radio station and FyA office to ask that the programs be made available to them as well. They wanted to learn along with their children. Radio Math also began to penetrate the populace in an unexpected way, even taxi drivers and market vendors were beginning to tune in.

> *"...I always believed in RLP/PARI....realized that the work was valid. However it was not until I visited the schools and experienced the appreciation of the teachers, students, and parents that I realized the potential was even greater than I had imagined."*
>
> Lic. Emilio Oros Mendez, RLP/PARI Executive Director

Throughout the pilot, the Radio Mathematics team observed the IRI class in several schools every day. The visits would inevitably end with an invitation to join the teachers and school director for a motivational talk over tea. Teachers who used Radio Math in their classrooms were proud of the progress of their students and cheerfully boasted how their second graders now knew more math than third-grade children!

On the last day of the Cochabamba pilot, the Radio Math team was just leaving the FyA office when a delegation of parents arrived from the pilot schools. Realizing that the pilot was coming to an end, they had been nominated by the other parents to ask that Radio Math be continued. After making an impassioned appeal, every member of the parents' delegation circled around to thank each member of the FyA team.

"We've raised their expectations. We can't let the parents and the teachers down, and what about the children?"
H. Gloria Esposito, FyA Director Cochabamba

NGO/Ministry Collaboration: Decentralization at Work

"...We were always behind the project because both children and parents liked the program. It produced results. It captured the spirit of FyA."
Victor Blajot

Encouraged by the outcome of the Radio Mathematics pilot, FyA and EDC sought additional funds from the Government of Bolivia and USAID to complete the IRI mathematics curriculum for lower-primary school, and to pilot a radio-based Spanish-language module for bilingual children in first grade. From the beginning, RLP's approach was unique because all financial, technical, and administrative responsibility for research and development was managed by FyA rather than by the MEC. This decentralized NGO-run approach was critical to the success of RLP, given the decay that existed within the political structure at that time.

Parents wanted to learn along with their children.

For more than a decade, near constant turnover at the ministerial level weakened the credibility of Bolivia's educational authorities and widespread, systemic corruption polarized the professional teaching corps. The general failure of the MEC to respond to the needs of its constituents served to strengthen the role of the union as the teachers'

advocate. By 1988, the teachers' union was the largest, most powerful union in the country, and a major political force. In essence, as teachers' loyalty shifted from the MEC to the union, it gained not only the ability to drive educational change, but also the power to influence the political agenda.

In the face of the deeply-rooted suspicion between the MEC and the teachers' union, RLP adopted a decentralized approach to institutionalization, cultivating a partnership with the teachers, students, and parents at the local level in FyA schools. Satisfied teachers, in return, advocated continuation and expansion of the program to other teachers, to educational authorities in their union, and to the MEC at the Departmental level. It was not, however, until RLP's programs were validated and supported by both the teachers and the union at the regional level that the MEC and RLP could even begin discussing national expansion.

Starting with an NGO

> *"...FyA strives not only to provide its own students with the best possible education, but to serve as a model for good education throughout the country."*
>
> Gabriel Codina

RLP was not designed as a MEC intervention but to test an alternative instructional program. Since FyA had government authority to run their schools in an autonomous manner, they were not obliged to seek MEC approval for the project, and they didn't. FyA was only interested in making a commitment to RLP if they had complete and unconditional authority over the project. After all, they had developed their reputation as national leader in education and were not about to risk it for IRI.

From the beginning, it was clear that RLP's integrity had to be protected from premature alignment with either the MEC or the union if the program was to be successful. On one hand, deep-seated cronyism and ever-changing leadership weakened the MEC's ability to provide long-term continuity to RLP. From 1987 to 1994, Bolivia had six Ministers of Education. Everytime the Minister changed, so did his policy advisors, program directors, and project managers. Given the short time that most Ministers were in power, immediate impacts were prioritized over long-term achievements. Meanwhile, the same political tension that gave the teachers' union momentum

also threatened RLP implementation. Interventions embraced by one group were automatically targeted by opposing groups.
Since the MEC was unable to guarantee continuity from one administration to the next, development of their internal capacity to design and manage IRI seemed daunting. This made investment in FyA even more attractive. Not only could FyA use their newly acquired skills to enhance RLP implementation, they could become a resource for the MEC and provide continuing technical assistance during institutionalization, and throughout curricular reform. Development of local expertise could also alleviate the dependence on expensive international consultants and improve cost-recovery.

Managing Growth

> *"...Strategic planning is not common in Bolivia. It's all theoretical. The rich history of planning and evaluation in previous IRI projects filled us with new ideas about how we could use these tools to strengthen our own work and promote long-term acceptance..."*
>
> Emilio Oro Mendez

From the beginning, RLP's expansion strategy supported the concept that the key to long-term success was successful management. This meant expanding IRI outreach at the same pace as the program's ability to provide services. It further supported the view of focusing initially on FyA schools, where the infrastructure necessary to make RLP a success was already in place.

Sustained exposure and positive results generated demand for IRI on behalf of teachers and parents.

From 1988 to 1994, the project almost doubled in size annually. This growth was not, however, unplanned. FyA began field operations with high levels of diffusion in three urban centers. By targeting these areas, RLP was able to focus more on quality concerns than logistical obstacles; and in essence, guarantee a successful first year. At the same time, sustained exposure and positive results generated demand for IRI on behalf of those teachers and parents not being served by the program. Establishment of a solid internal methodology further enabled RLP to strategically plan their response to different sets of challenges like bilingualism, rural outreach, decentralized supervision, and teacher training.

Curriculum Development: A Lengthy Process

> *"It took us one year to create the master plan, with help from outside consultants. But the storyline and format was ours, and we created this program for Bolivian children."*
>
> Jaime Reyes, Director of Curriculum and Production, PER.

The master plan was created by following suggested guidelines for interactive methodology: using segmentation, logical sequencing, and prior knowledge. To design the second grade program, RLP's team first analyzed the national Bolivian math curriculum. They then compared it to the IRI programs developed in Nicaragua. Given the positive results of the pilot program, RLP decided to begin with a local adaptation of Nicaragua's second grade lessons. In order to represent the classroom viewpoint, the team included input from a group of three certified, practicing teachers. Their strength was practical teaching, not theoretical material; and their participation helped ensure that each exercise and problem strictly adhered to the logical order in which the children should learn the content.

This approach was advantageous for several reasons. First, the recorded pilot lessons afforded RLP a one-month margin for error. Second, review and revision of the original Radio Math programs gave RLP's curriculum team a unique opportunity to begin with a validated product, to use comparative testing to improve upon that product, and to internalize the IRI methodology throughout the adaptation process. Because of this, RLP was able to initiate in-school broadcasts within several months after project start-up; and the local staff was able to gain a solid understanding of the IRI methodology prior to undertaking the complex task of restructuring the third grade curriculum the following year.

The team made sure that each exercise adhered to the logical order in which the children should learn the content.

In 1988, RLP worked with 10,000 second-grade students in FyA schools in the Departments of Cochabamba, Santa Cruz, and the Beni. The following year, the same cohort was used to validate the third-grade programs while the revised second-grade programs were made available to FyA schools in two additional Departments — Chuquisaca and Tarija. Enrollment jumped to 13,000 that year. In 1990, Bolivia developed and validated a complete fourth-grade mathematics curriculum using IRI. While the original cohort participated in this validation, overall enrollment doubled as FyA opened second-grade matriculation to all public schools in the five participating Departments. That effort continued into 1991 with development and validation of the fifth-grade mathematics program, as well as the design and field test of the first IRI curriculum in preventive health.

The lapped year design (Table 2) was followed throughout the validation, dissemination, and revision of the complete mathematics and health curriculum. Its employment helped RLP control for errors in programming and thus guarantee the MEC an improved product for institutionalization. Because of this, RLP has consistently produced learning gains averaging 50% higher than the traditionally taught cohort at every grade level.

TABLE 2: RLP/PARI DIFFUSION					
Year	Departments enrolled	Radio stations	Students enrolled	Grades diffused in FyA schools	Grades diffused in MEC schools
1987	2	Cassette	450	Partial 2	
1988	3	8	10,000	2	
1989	5	10	13,000	2,3	
1990	5	18	25,000	2,3,4	2
1991	6	18	70,000	2,3,4,5	2,3
1992	7	24	120,000	2,3,4,5	2,3,4
1993	9	22	180,000	2,3,4,5	2,3,4,5
1994	9	24	250,000	2,3,4,5	2,3,4,5

Building Partnership with the Teachers

"...My reflections about the difficulties which confront education in Bolivia are not theoretical. Through RLP/PARI, I've had an opportunity to visit every corner of Bolivia. Everywhere I go I talk with the teachers, listen to their perspective, observe their reality, breathe their air. I now have a broader vision about the issues confronting education, I have evolved along with the program.."

Betty Barron de Luna, RLP/PARI Director of Evaluation and Implementation

From the beginning, RLP has viewed teachers as its foundation for success, and searched for ways to transform their role from outsider to participant to advocate. Because of this, RLP has explored innovative ways to form partnership with the teachers—by responding to their needs, by reinforcing their role in the classroom, and by acknowledging their unique contribution. In this respect, RLP's approach to sustainability has been one of integrating IRI within the existing system, rather than conditioning the system to fit the methodology.

By basing the program on the reality of the teacher, RLP developed an effective instructional package that facilitated easy adoption of the methodology. One key element of the package was the teachers' guide. For poorly trained teachers, access to a detailed teachers' guide alerted them to the content of the daily lesson, and relieved them of some of the anxieties of preparing their own lesson plan. The teachers' guide, which provided both problems and answers as well as step-by-step instructions for resolving each exercise, reinforced teachers' own

knowledge of core subject material. Participation in RLP carried the additional guarantee that all elements of the "official curriculum" would be presented by the end of the school year, and taught correctly. It elevated teachers' sense of pride to see their students doing so well. On the other hand, better teachers could continue developing their own daily lesson plans for use in the post-broadcast session. These plans could be based on the lesson content outlined in the teachers' guide as well as on the teachers' professional observations.

Responding to the Teachers

> *"I identified with FyA and worked to integrate FyA's community-teacher focus into the program."*
>
> Betty Barron de Luna

RLP staff traveled throughout Bolivia to train participating teachers, observe the IRI classes, and participate in local evaluations. Every day of the school year, the IRI lessons were broadcast and monitored by trained staff visiting participating schools. These visits were important not only because they provided feedback on the lessons, but because they made the participating teachers and school principals feel important. For many teachers, this was the first visit that they had received from an education authority in years. Knowing that RLP valued their participation and sought their advice strengthened teachers' identification with the program.

The observations also provided keen insight into teacher acceptance and implementation obstacles. In 1988, 243 FyA teachers participated in the validation of the second-grade IRI math curriculum in Santa Cruz, Cochabamba, and the Beni. At the end of the school year, summary meetings were held with teachers in all three Departments. The purpose of these meetings was for teachers to share their experiences using IRI with the RLP staff revising the second-grade materials.

Regarding the curriculum, many teachers noted surprise at children's ability to keep-up with the rapid pace of instruction and master concepts (such as teaching multiplication tables beyond five) that went beyond the official Bolivian syllabus. Other teachers said they had learned more about the pedagogy of mathematics from the programs. A major criticism was that the time required of the teacher to prepare for the radio class was too demanding. Teachers claimed that copying exercises onto the blackboard prior to the broadcast took valuable time away from other subjects. They also felt the programs

were too generic. Teachers from Santa Cruz wanted to hear more of their style of music, and teachers from the Beni wanted characters who talked like themselves.

In every meeting, teachers asked that Radio Math be continued through grade five, the last year of the primary-school cycle, even at the cost of sacrificing the pilot language module. They argued that it would be a disservice for children to learn by IRI in the lower grades only to be "dumped" back into the mediocrity of traditional instruction later on. Furthermore, the teachers claimed that it would be a disincentive for them to have to restructure their fourth and fifth grade programs to pick-up where the radio left off.

RLP listened to the teachers' concerns and addressed the issues they raised. The revised edition used popular regional music, and integrated "radio teachers" from different parts of the country. The lesson format was also modified to have the radio dictate problems throughout the broadcast, relieving the classroom teacher of having to copy the exercises beforehand. Given the significaQnce of these changes, teachers who participated in the first-year evaluation were surprised and pleased to discover the modified curriculum the following year. Surprised, because their suggestions frequently go unheeded. Pleased, because they were able to influence a national program. This knowledge further enhanced teachers' identification with and sense of contribution to the program.

The teachers' guide reinforced teachers' own knowledge of core subject material.

Perhaps of greatest significance, however, was RLP's decision to respond to teachers' concerns about student preparation and to facilitate development of the IRI mathematics curriculum through fifth

grade. According to Gabriel Codina, "I feel very satisfied that we were able to complete the math cycle when no other country had." Other countries like the Dominican Republic, Nicaragua, Honduras and Costa Rica had begun the process, but Bolivia was the only country to complete the radio math curriculm up to the fifth grade.

Honoring Recommendations

> *"...Motivation, follow-through, and training are the keys to RLP/PARI's success. We continued to provide training, even at our own cost..."*
>
> H. Maria Otaegui

RLP's efforts to solicit and follow-through on teachers' opinions created a bond between the program and the teacher that would last through the life of the project. That sense of partnership came in handy in 1989 when it was rumored that a potential change in FyA leadership could result in the withdrawal of institutional support to RLP. It was not that FyA was dissatisfied with the program but rather concerned about the impact that stringent USAID reporting requirements might have on their autonomy.

In response to this serious situation, RLP supervisors, acting on their own initiative, began to collect recorded testimonies from parents, teachers, students, and even the radio stations in defense of the program. The testimonies were broadcast city-wide in Cochabamba, where reports of a planned march in support of RLP began to circulate. Fortunately, the new FyA Directorate voted not only to continue with RLP but to provide IRI teachers with additional training support.

Although this was the first serious challenge to IRI's ongoing implementation, it was not the last time that RLP's constituency came together to advocate the program. Not only did teacher support surface when challenged by the union, but time and time again as the MEC considered institutionalizing the program within their national plan.

Enhancing and Rewarding Teacher Knowledge

Partnership with the teachers was further enhanced by emphasizing the importance of their contribution to the radio class. Every day, teachers were tasked with important activities that only they, and not

the radio, could do. For example, teachers were called upon to assess and respond to the learning needs of slower students. This was revolutionary because it challenged the traditional practice of tailoring instruction to the fast learner while overlooking the special needs of the slower student. Teachers were also charged with monitoring their students during problem-solving activities so that they could reinforce deficient skills in the post-broadcast session. This, too, was innovative because it prompted teachers to be needs-driven rather than routine and impersonal. By facilitating interaction with the radio and by leading students through exploratory activities, the teacher was transformed from classroom lecturer to learning facilitator. Such direct involvement served to reinforce teachers' sense of partnership with the program and the methodology.

The Teachers' Guide

RLP also provided incentives for teacher follow-through. Ownership of the teachers' guide was one such incentive. The form and content of the teachers' guide changed as the program was implemented.

> *"The guide improved due to the teachers' own suggestions. After all, they used the programs everyday in their classrooms...It took more than five years for the guide to evolve."*
> Jaime Reyes

On completion of the school-year, the guide passed from RLP to the teacher. Because teachers were not given instructional materials by the state, they valued having access to a detailed instructional program that they could use independently of, or in conjunction with, the radio.

Teacher Training

Training in the methodology was another incentive however, not all training strategies were successful. A series of strategies were tried over the course of the project. The first few years, a small group of people traveled around providing training. As the program grew, four or five people were not enough to reach teachers in all of Bolivia. So RLP had to form multiple teams, each of them responsible for several Departments in the country. These teams would travel extensively for a month at the beginning of the school year however, the demand was such that they were not always able to train all participants by the first week of classes.

An example of a training approach that never really took off was the attempt to convert MEC supervisors into training multipliers. According to Emilio Oros,

> *"When we had to train superviors and adminstrators from the Ministry of Education so that they would pass on what they had learned, we had training sessions and the supervisors did learn. But we never really thought that they in turn taught the teachers. We had to do twice the work to retrain teachers who needed our support."*

From a technical standpoint, the teachers can learn to use the methodology in only one day. But they also need to understand the learning theory, and this takes more time. By agreement with the Ministry of Education, the training was completed in two mornings or afternoons. First there was an introduction to the methodology, followed by a review of basic skills and content, then an explanation of the teachers' role in the program, and finally a model class with children. An important part that took up almost the whole second morning was training in how to use the teachers' guide.

Although RLP restricted formal participation to trained teachers, the one-day training was free of charge. This practice diverged from traditional training where the teacher would have to pay to attend a training seminar. Once RLP became institutionalized, the MEC went on to grant leave with pay for teachers in training. Perhaps best of all, teachers who attended the initial IRI training, used IRI regularly in their classroom, and kept a post-broadcast log were rewarded with a certificate of merit at the end of the school year. School directors who regularly reviewed their teachers' logs were also certified. When RLP/PARI became recognized as Bolivia's official mathematics program in 1992, the MEC valued all certificates with five points towards teachers' promotions and pay raises.

Teachers as Advocates

Satisfied teachers became powerful advocates of RLP. Not only did they encourage other teachers to join the program, they made personal sacrifices to continue their own participation. Some teachers valued participation so much that they brought their own radios to school or paid for batteries out of their salary. Others came to school during their day off—just for Radio Math. Parents took note of teachers' initiatives and began to provide support in small ways. Where they could, parents pooled money to buy the school a radio or pay for its

maintenance. Others paid for teachers' transportation to continue Radio Math during off days.

Because many people heard the radio program word of its impact spread quickly. Sometimes, the parents of children not participating in IRI made their schools accountable for joining the program the following year. More frequently, teachers who were not using the methodology noticed such a positive change in the attitude and effectiveness of their colleagues using IRI that they requested permission to enter the next year. School directors were another vehicle for passing the word, especially when the principal had led an IRI class herself.

Instructional Design: Catering Learning to the Learner

> *"...The IRI technique was a novelty. We were versed in using radio with adults, but using it for children was new. From the first day we noted that IRI released an avalanche of emotions in the students; and the teachers were impressed by the quality."*
>
> Jaime Reyes

Not only has IRI dramatically changed the way that teachers teach, it has also changed the way that children learn in Bolivia's schools. When RLP was designed, teaching practices were not conducive to student learning. There were no textbooks in the schools, the teaching method of choice was whole-class instruction, and little positive feedback was provided. Many teachers were either not prepared, ill prepared, or too uncertain of the material themselves to provide a solid foundation. As a result, instruction in core subjects was inadequate and related student repetition and drop-out was high.

Breaking with tradition, IRI places the student at the center the learning process by eliciting active student participation. It provides ample opportunity to apply and practice what is being learned. At the same time, it provides constant feedback to its user by modeling problem-solving skills and reinforcing correct answers. By challenging children to become active learners, IRI awakens their desire to participate in and contribute to their own education. This section discusses how IRI has contributed to improving education in Bolivia's schools.

Making Instruction Effective

One of the reasons that IRI has been used so successfully in Bolivia is because of its instructional design. IRI programs are effective and entertaining. They sequence the introduction of new learning concepts, engage students in problem-solving, and lead students to subject mastery through inductive and participatory activities.

By challenging children to become active learners, IRI has awakened their desire to participate in their own education.

IRI lessons follow a logical sequence. They present and explain new material while reviewing concepts already taught. To begin, a comprehensive master plan is mapped out by content experts using the official curriculum as its basis, and daily lessons are outlined. The resulting IRI program has five or six brief learning segments; apart, each segment is a miniature module carrying students one step closer to mastery of specific learning objectives. Woven together, they become a carefully crafted blend of new skills and reinforcement practice in support of common instructional goals.

> *"...We learned as we went along. Continuing formative research was critical in providing us with important insight into the way that teachers and students perceived IRI. It enabled us to tailor the curriculum and methodology to their needs."*
>
> Emilio Oros Mendez

A strategy for evaluating lesson effectiveness was also built into the master plan. Rather than wait until the end of the school year to test the instructional integrity of the programs, IRI used continuous formative evaluation to fine-tune the curriculum as it was being developed. This research tailored the instruction to the learning needs and interests of its users. Qualitative observations of student interaction during the IRI class were recorded on a daily basis. Short bi-weekly tests were also administered to measure student knowledge of concepts to be introduced over the next two weeks, to assess student comprehension of concepts taught over the past two weeks, and to evaluate children's retention of messages presented in the preceding month. This feedback was used to formulate future lessons and to revise existing programs.

Encouraging Active Student Participation

IRI keeps students interested by making learning enjoyable. The radio lessons enliven the classroom atmosphere through the imaginative use of stories, songs, physical activities, and role plays which invite the active participation of the student in the learning process. Although children respond to questions and activities posed by the "radio teachers" every 20 seconds on the average, the nature of that interaction is the product of creative scripting. Today, more than 600 Radio Math and Radio Health lessons have been validated in Bolivia. They all combine entertainment with education. Such lively participation is central to the effectiveness of both the medium and the methodology.

Making Learning Relevant

IRI stimulates learning by presenting familiar situations which enable students to apply what they have learned. It draws heavily on the student's reality to explore basic mathematical concepts. All examples used during the radio lesson mirror the child's environment. Decisions which Bolivian children confront everyday, like buying a snack during recess, playing soccer after school, or sharing a piece of fruit, are modeled into exercises that teach the basics of subtraction, division, and fractions.

Given the sensitivity of reaching a socially, culturally, and geographically diverse audience, first-hand knowledge of the contextual reality of the students was researched throughout the course of the project. Travel to participating communities allowed

RLP staff to visit neighborhood schools, observe classes, and gather information about students' understanding of mathematics. The staff participated in recreational activities such as playing games and drawing pictures to learn more about students' interests, motivations, and interpretation of specific words and images. They also observed children in their home and community environments. Given the high degree of convergence found across regions at the school level, and the many differences found at the community level, RLP staged the school as the central unit of activity in each IRI program. This ensured both recognition and relevance for the target audience—children in school.

Making It Rewarding

RLP's programs were designed especially for children. Because they were more actively involved, students learned more; and because the programs were structured, entertaining, and relevant, more students could keep-up with the instruction, apply what they were learning, and do better overall. Improved performance not only enhanced students' self-esteem, it also reinforced teachers' sense of contribution. Parents, too, were encouraged by these positive results and supportive of the intervention. Satisfied users became RLP's most convincing advocates. Every year the program expanded as more parents and teachers took stock of IRI's impact. In this manner, RLP/PARI grew to serve more than 600,000 primary-school students over the course of its implementation.

Institutionalization and New NGOs: Adapting to Change

> *"...FyA had the appeal of conducting quality experimental programs. We have a reputation for seriousness, control, and responsibility. There came a time, however, when FyA's contribution was complete, when the future of the program was best addressed elsewhere..."*
>
> Gabriel Codina

FyA perceived RLP's greatest contribution not as being "the solution" to Bolivia's education woes, but as being the most cost-effective, immediate, and manageable option for improved learning while the Ministry went about the business of upgrading the teaching corps. Since improved teacher quality was viewed as a generational undertaking, RLP had to become more than just another "four-year

experiment." It had to respond to the long-term needs of both its users (the teachers) and its beneficiaries (the students).

Although FyA had made a commitment to shepherd RLP into their own schools, they had never intended to become a vehicle for national implementation. In spite of this, overwhelming demand for IRI by underserved public schools compelled FyA to place access to IRI in the public domain in 1990. Enrollment doubled that year, tripled again in 1991, and gave all indication of continued expansion in following years. Clearly the potential for RLP in Bolivia had grown beyond even FyA's or the MEC's wildest dreams.

> *"...In the beginning, I'm uncertain that the MEC really understood the potential of PARI. My first visit to Cobija to evaluate the program was not impressive. It was not until I began to visit the schools and see the impact of the mathematics program on the students and the teachers that I came to realize its importance. When thousands of teachers throughout the country tell me that the program is valuable to them, there must be something to it..."*
>
> Prof. Jorge Ayala

Since FyA had neither the resources nor the mandate to supervise public schools outside of their own network, they made a conscious decision to pass RLP management to the MEC in 1991. By that time, RLP's technical, implementation, and supervisory systems were all in place, and the IRI curriculum was fully validated. Realizing that FyA leadership of RLP would soon be ending, and that their role would be severely reduced, the core technical group of FyA employees who had managed RLP from its inception and guided its growth as a project established their own NGO, Programa de Educacion por Radio, to facilitate successful MEC transition and to leverage union support.

Because they were more actively involved, students learned more.

Founding Programa de Educacion por Radio

> *"...Most Bolivians work for salary, not for enterprise. We came into Radio Math having worked together as a team; however it was not until RLP moved into an office outside of FyA headquarters that we gained autonomy. We began to make decisions that we would not otherwise have had to. Our team evolved along with RLP; although we remained loyal to FyA, our identity was increasingly tied to the project. When the time came to transfer the program from FyA to MEC management, we founded PER. We had grown together so much, we couldn't risk losing that continued sense of contribution and growth...that affinity. Even though we were anxious and at times ambivalent, our decision was obvious..."*
>
> Emilio Oros Mendez

Tremendous project growth in 1988 required more administrative oversight than FyA had anticipated, prompting the project staff to move from FyA headquarters into its own office and hire its own full-time staff. Once they began operating in an autonomous fashion, the identity of core staff became even more strongly aligned with the project as they matured professionally and as a team.

IRI draws heavily on the student's reality to explore basic mathematical concepts.

By 1991, more public schools were participating in RLP than were FyA counterparts. Since full responsibility for training and supervising non-FyA schools fell on RLP's staff, their credibility as education authorities grew independently of FyA. When FyA first proposed transfer of project management to the MEC, three related issues became evident:

- Public-sector coordination meant dissolving the core group of FyA managers and technicians that gave RLP its vitality;
- The MEC still lacked the managerial and technical capability to pick-up where FyA left off; and
- RLP's project team realized that their professional commitment to institutionalizing RLP outweighed their personal concerns about being reabsorbed into FyA.

PER's organization in 1991 gave definition to a five-year transitional management plan for RLP, establishing both policy and precedent: policy, because IRI was the first national education intervention adopted by the MEC prior to formalizing the national education reform; precedent, because of PER's bold decision to place their prestige on the line and organize union support for MEC implementation.

'IRI has provided us with an outlook on what we must do to reach our goals.'

Under PARI, the MEC was responsible for national supervision of the IRI program and for supporting recurring costs within the education reform. PER was accountable for training MEC personnel applying the IRI technology in program development, implementation, and management. FyA was responsible for training and supervising their own network of participating teachers; and EDC was charged with ensuring smooth collaboration among these institutions. Impact from

this concerted effort paid off quickly, and word of the successful collaboration spread. In 1992, more students participated in PARI than the total of all previous years. In 1993, IRI expanded to all nine Bolivian Departments, and by 1994, MEC supervisors and union representatives articulated unanimous support for PARI by ratifying a joint resolution in public ceremony.

In 1993, the last completed school year for which data are available, Interactive Radio Learning reached several milestones in its development.

QUANTITATIVE INDICATOR/OUTPUT	PLANNED	ACHIEVED[6]
Radio math usage in all 9 departments	9 dptos	9 dptos
Radio health curriculum validated in 20 schools in 3 departments	3 dptos 20 schls	4 dptos 200 schls
National infrastructure of trained teachers, school directors, and supervisors	7,500 Trained	8,000 Trained
Math students (cumulative)	150,000	350,000
Health students (cumulative)	50,000	60,000
Teachers guides - math	4 grades	4 grades
Teachers guides - health	3 grades	2 grades
Math lessons produced/revised	540	540
Health lessons developed cholera pilot - 1992 grade 3 - 1993 grade 4 - 1993 grade 5 - 1994 stories for school break bilingual pilot - 1994	 10 30 30 30 20 10	 10 30 30 11
Bolivian technicians trained	20	40
Promotional video tapes	5	2

Final Thoughts

Clearly, the dedication of RLP/PARI's seasoned staff and its focus on popular participation has facilitated IRI's "institutionalization" within the MEC; however, nurturing PARI within that everchanging structure presents the biggest challenge to its sustainability. For the past three years Bolivia has embarked on the design of a comprehensive educational reform package that will define all future investment in the sector. Continued support for PARI's

implementation within the reform is critical, at least until the MEC is able to strengthen their teaching corps and extend equitable, high-quality instruction in its schools. As Jorge Ayala explains,

> *"...IRI was never meant to be the solution. Nevertheless, it has helped us get across a sense of reasoning, planning, formation. It has opened our horizons. It has provided us with an outlook on life, on how we live, on what we must do to reach our goals. Until we are able to put something more effective, more encompassing in its place, my responsibility is to see that IRI continues."*

Sometimes the key to the future is more suitably found in the past. Father Victor Blajot encourages PARI to be faithful to the ideals with which it began.

> *"As we look to decentralization, parents and other community members will be "reenfranchised" in the education system and provide continuing oversight at the community level. Decisions affecting teacher selection and curricular concerns will be community driven. Education will become more responsive to community needs. RLP/PARI is a serious project. Schools embrace it because it helps the teachers to be more effective. Parents like it because their children are excited about learning. Students like it because they are actively involved. This is, after all, what education is all about..."*

ANNEX A: Chronology of Events

Radio Learning Project: 1986 - 1991.

1986

- Comisión Episcopal de Educación (CEE) reviews the state of Bolivian primary education and recommends that mathematics be improved at all levels. Interactive radio is identified as a potential intervention to address this need.
- At the invitation of USAID/B, EDC conducts a feasibility study to assess the potential of using IRI in Bolivian public
- FyA and EDC receive an USAID/B grant to pilot the use of interactive radio over a three-month period.

1987

- Training of FyA staff participating in second-grade pilot.
- Pilot implemented in FyA schools. Radio intervention significantly increases children's understanding (64% pretest, 90% posttest) of basic concepts taught.
- FyA and EDC collaborate on the design of Radio Learning Project.
- Pretest second-grade control group to establish baseline for future curriculum development activities.

1988

- FyA and EDC contract with PL 480 and USAID/B to provide local and international technical services under RLP. The objectives of the project include: (1) develop and validate a comprehensive interactive-radio mathematics curriculum for lower-primary school; and (2) pilot a first-grade radio-based spanish-language program.

- ❖ RLP develops 130 half-hour interactive-radio lessons for daily transmission of second grade mathematics. The series is validated in the Departments of Santa Cruz, Cochabamba, and the Beni. Summative evaluation supports the impact of the radio intervention. (Posttest mean scores: 46% control, 66% experimental.).

- ❖ Teachers request that RLP continue Radio Math through the last year of primary school, fifth grade—even at the cost of sacrificing language to do so. AID modifies RLP's SOW.

1989

- ❖ 2nd grade math series is revised using formative and summative evaluation results. New version is broadcast.

- ❖ 130 3rd grade Radio Math programs produced and validated using lapped-year design. In addition, cohorts from the Santa Cruz and Cochabamba regions were selected for inclusion in a four-year tracer study. Experimental cohort continues to outscore the control group by nearly a half. (Grade 3 year-end mean scores: 37% control, 55% experimental.) Sucre and Tarija join RLP bringing the total number of participating Departments to five.

- ❖ In response to teachers' requests, a three month pilot is undertaken to test the potential of teaching set-theory by interactive-radio. Summative results do not substantiate significant learning gains in students. RLP stands by original decision to include modern math as a teacher-led post-broadcast activity rather than as a "radio" subject.

- ❖ Six month pilot initiated to test the feasibility of applying interactive-radio to the teaching of preventive-health care. Funding for this activity was received through a separate USAID/B grant. Summative evaluation indicates highly significant levels of student comprehension as well as implied practice. This pilot is the first effort to teach health by radio anywhere in the world. The results were published in an international journal.

1990

- 3rd grade math series revised using formative and summative evaluation data. The revised series is broadcast in all participating Departments.

- The 4th grade series, consisting of 135 lessons, is validated using year-long formative, summative, and longitudinal methodologies. Results produce outstanding gains. Experimental cohort's scores nearly double those of children taught by traditional methods. This is the first successful effort of any country to teach upper-primary school mathematics by interactive radio.

- The Ministry of Education and Culture signs a Memorandum of Understanding with RLP to broadcast the 2nd, 3rd, and 4th grade programs in six Departments, including Pando. The MEC conducts a separate assessment of their own institutional capability to integrate and supervise interactive radio as part of the official Bolivian curriculum.

- An external cost-effectiveness study of RLP concludes that the annual recurrent cost of using interactive-radio is just $0.81 per student, and the incremental gain in learning equal to 1 1/2 times that of traditional instruction.

1991

- Bolivia becomes the first country in the world to develop a fifth-grade mathematics curriculum using interactive radio.

- The complete series of 135 lessons is validated through a regimen of bi-weekly testing and through summative and formative measures. Summative evaluation data indicate that radio students have greater dominion of basic mathematics principles than non-radio students. (Standardized posttest mean scores: 40% control, 55% experimental). In addition, the project demonstrated that children who had the benefit of all four years of radio instruction have an even greater advantage in mathematics than children who have three years or less (71%).

- Formative and summative evaluation results used to revise the 4th grade math series. The revised programs are broadcast in six Departments along with the updated 2nd and 3rd grade curricula, and the new fifth-grade programs.

Interactive Radio Learning: 1992 - 1996.

1992

- USAID, EDC, the MEC, and the Ministry of Health (MOH) sign a bilateral agreement to implement Interactive Radio Learning (IRL). The objectives of this landmark initiative are to: (1) integrate Radio Math into the Bolivian curriculum, and extend its diffusion to all 9 Bolivian Departments; (2) develop and pilot a complete "Radio Health" curriculum for children in grades 3 - 5; and (3) strengthen the MEC's ability to manage continued implementation of IRL upon termination of USAID/B funding.

- MEC assumes national supervision of IRL and passes a Ministerial Resolution declaring interactive radio the official mathematics program" of Bolivia.

- La Paz becomes the 7th Department to join IRL. All four grades of validated mathematics curriculum is broadcast.

- A KAP survey is conducted to establish a baseline for Radio Health curriculum development. A pilot module on cholera is broadcast and evaluated in the Departments of La Paz, Cochabamba, and Santa Cruz. Results of the evaluation confirm the power of using interactive radio to teach basic health concepts and to motivate behavior change.

1993

- The complete mathematics curriculum is disseminated throughout all 9 Departments in Bolivia.

- ❖ The complete 3rd and 4th grade Radio Health series is produced and validated. Demand for Radio Health is tenfold more than anticipated!

- ❖ An international congress promoting Bolivia's pioneering efforts in mathematics and health was held in Santa Cruz, October 1993.

1994-1996

- ❖ MEC assumes full implementation responsibility for IRL. Project to be integrated into the National Education Reform Act.

ANNEX B: Endnotes

[1] Technical assistance fo rthe pilot was provided through Education Development Center (EDC), a Boston based NGO, and funding was contributed by the United States Agency for International Development's overseas Mission in Bolivia (USAID/B).

[2] Iriate G: ***Analisis de la Realidad Boliviana: Aspectos Sociales,*** SENPAS, La Paz, Bolivia, 1985.

[3] The World Bank: ***Trends in Developing Economies 1989,*** The World Bank, Washington, D.C., 1989.

[4] Centro Boliviano de Invetigación y Acción Educativas: ***La Deserción Escolar del Ciclo Basico en Bolivia.*** Serie: Estudios Educativos No. 26. CEBIAE, La Paz, Bolivia, 1987.

[5] This report gathers the evidence on the direct and indirect positive effects of IRI on educational efficiency including improved student learning and enhanced teacher effectiveness. Nevertheless, while a solid body of research clearly demonstrates that mastery of literacy, numeracy, communication, and information processing skills prepares students and teachers to be more productive in the formal and informal work force as well as at home, the interplay of social and economic outcomes frequently finishes a distant second to the inevitable, "how much will it cost?". A 1990 study conducted by economist Dean T. Jamison calculated the developmental cost of Bolivia's Radio Mathematics program to be $1.28 per student (spread over 300,000 participating students), with an annual incremental cost of daily implementation, including hardware, of $.81 per student. To put this in perspective, it is worthwhile mentioning that the average cost of traditional mathematics instruction was $13.00 per student per year at the time of Jamison's study; and that the additional money spent on interactive radio yielded an impressive 50% increment in student learning! In otherwords, according to Jamison's study, IRI's "efficiency ratio" of incremental effectiveness (.9 effect size) to incremental cost was even more attractive than that typically found by providing textbooks or training teachers.

[6] ESTIMATE, SUBJECT TO MODIFICATION.

[7] Fryer M: ***Bolivia Mathematics Pilot.*** Radio Learning Project Report, Education Development Center, Newton, MA. 1987.

[8] Fryer M: ***First Year Summative Evaluation: Second Grade Mathematics, Bolivia 1987 -1988.*** Radio Larning Project Monograph. Washington, D.C.: Agency for International Development. 1989.

[9] Jamison, DT, Fryer M, Barron de Luna B, Oros Mendez, E: ***El Proyecto de Educacion por Radio en Bolivia: Evaluacion de Costo-Efectividad.*** Radio Learning Project Monograph. Washington, D.C.: Agency for International Development. 1990.

[10] Fryer M: ***Health Education through Interactive Radio: A Child-to-Child Project in Bolivia.*** Health Education Quarterly, Vol 18(1), Spring 1991. New York: John Wiley & Sons.